Cottam Solar Project

Outline Battery Storage Safety Management Plan

Prepared by: Lanpro and Island Green Power

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Cottam
SOLAR PROJECT

Contents

Issue Sheet

Report Prepared for: Cottam Solar Project Ltd.
DCO Submission

Outline Battery Storage Safety Management Plan

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1 Executive Summary

1.1.1 This report has been prepared on behalf of Cottam Solar Project Ltd. (the 'Applicant') in relation to an application made to the Secretary of State (SoS) for the Department for Business, Energy & Industrial Strategy (BEIS), under section 37 of the Planning Act 2008, seeking a Development Consent Order (DCO) for the Cottam Solar Project (the 'Scheme').

1.1.2 The Scheme is a nationally significant infrastructure project comprising a ground mounted solar photovoltaic generating station with a gross electrical capacity of over 50 megawatts and associated development including an Energy Storage Facility. The DCO Application (including the Environmental Statement **[EN010133/APP/C6.2.1 – C6.2.21]** assumes that the form of energy storage will be battery storage and as such, the Energy Storage Facility (as it is termed in the draft DCO Schedule 1), is often referred to as a 'BESS' (Battery Energy Storage System throughout the application documents). The Scheme is to be located at four distinct areas, as described in Chapter 3 of the Environmental Statement (ES) **[EN010133/APP/C6.2.3]**.

1.1.3 The DCO Application proposes that the BESS for the Scheme will be located within Cottam 1. Two options are proposed for the BESS (within Work No. 2 and Work No. 3 as shown on the Works Plans **[EN010133/APP/C2.4]**).

1.1.4 Illustrative Site Layout Plan, Cottam 1, West A **[EN010133/APP/C6.4.4.3]**. shows the BESS. Illustrative Site Layout Plan, Cottam 1 West B **[EN010133/APP/C6.4.4.4]** shows additional areas for BESS. If Option A were pursued (the smaller option), a more extensive area for solar panels can be provided. If Option B is pursued, a smaller area for solar panels will be provided.

1.1.5 The solar array Sites, associated substations and BESS are to be connected to the National Grid at a substation at Cottam Power Station. This report outlines the key fire safety provisions that are considered likely to be included in the design of the proposed BESS facilities.

1.1.6 Prior to the commencement of construction of the BESS, Cottam Solar Project Ltd. will be required to prepare a Battery Storage Safety Management Plan (BSSMP) which must be in accordance with this Outline BSSMP. As part of the BSSMP, the Applicant will take into account the latest good practices for battery fire detection and prevention, along with the emergency response plan, as guidance continues to develop in the UK and around the world.

1.1.7 There are several battery storage technologies available to system designers. The system being used for assessment is the LeBlock modular battery system by LeClanché. These are high density 744kWh lithium-ion batteries including a fire suppression system. The exact technology and system chemistry type is still to be determined, but it will be a lithium-ion battery cell type. The popular types of this chemistry within the lithium-ion family are Lithium Nickel Manganese Cobalt Oxide ($LiNiMnCoO_2$) known as "NMC" after the three key active materials or Lithium Iron

Phosphate (LiFePO4) known as "LFP". The final battery chemistry will be confirmed as part of the detailed design prior to the commencement of construction.

1.1.8 For the purposes of this document a concept design has been considered that uses a BESS system based upon LFP lithium-ion battery technology that is currently used on other sites being developed by the Applicant. This is considered to be a reasonable worst case for the purposes of the assessment in terms of safety.

1.1.9 The BESS will be designed in accordance with the UK and internationally recognised good practice guidance available at the time.

1.1.10 The overall approach is to follow the Health and Safety Executive's (HSE) hierarchy of controls:

- Elimination;
- Substitution;
- Engineering Controls;
- Administrative Controls;
- Personal Protective Equipment.

1.1.11 This document details the types of safety systems available on the market at present, along with risk reduction barriers which are likely to be incorporated into the system to be installed at the Sites. It is possible that by the time of construction that all solid-state batteries, or other battery technologies may be available. This will be reflected in the BSSMP approved by the Local Planning Authorities in consultation with the HSE, Lincolnshire Fire and Rescue Service and the Environment Agency.

1.1.12 A summary of the anticipated fire safety provisions are as follows:

- The BESS will be designed, selected, and installed in accordance with international guidance, good practice, and related standards.
- Risk assessments will be carried out for the entire system and elements across the project lifecycle.
- The specific location of the BESS will be chosen to minimise impacts on receptors (albeit this is inherent in the DCO Application as it has been factored in to the design process to date).
- Separation distances between components will be selected to minimise the chance of fire spread.
- Equipment will, where possible, be selected to be fire limiting, such as selection of transformer oils with low flammability and the fire resistance of the BESS containers.
- In the case of the BESS, it will be designed with multiple layers of protection to minimise the chances of a fire or thermal runway.

- All equipment will be monitored, maintained, and operated in accordance with manufacturer instructions.
- The BESS will include integrated fire detection with automated suppression systems.
- 24h monitoring of the system via a dedicated control room.
- The Applicant will have a dedicated emergency plan in place, with consideration of credible plant failure scenarios.
- Communication with the local fire services with engagement early in the project and continuing across design and construction phases. This will ensure a robust emergency plan and material is available in an emergency. This anticipates Dame Marie Miller's Lithium-Ion Battery Storage (Fire Safety and Environmental Permits) Bill, due for its second reading in March 2023 and will ensure a robust ERP.

2 Introduction

2.1 Scope of this Document

2.1.1 This outline BSSMP document, produced by the Applicant, outlines the key fire safety provisions for the BESS proposed to be installed at Cottam Solar Project including measures to reduce fire risk and fire protection measures.

2.1.2 This document provides a summary of the safety related information requirements which will be provided in advance of construction of the BESS. The purpose of this outline BSSMP is to identify how the Applicant will use good industry practice to reduce risk to life, property, and the environment from the BESS.

2.1.3 Prior to the commencement of construction of the BESS, the Applicant will be required to prepare a BSSMP which must be in accordance with this outline BSSMP. As part of preparation of the BSSMP, the Applicant will take into account the latest good practices for battery fire detection and prevention, along with the emergency response plan, as guidance continues to develop in the UK and around the world.

2.1.4 As the operational phase is anticipated to commence no earlier than 2026, reference to current measures and guidelines are included here. However, this document will be updated prior to construction of the BESS to take account of prevailing guidance.

2.2 Project Description

2.2.1 For the purposes of this document a concept design has been considered that uses a BESS based upon LFP lithium-ion battery technology that is currently used on other sites being developed by the Applicant. This is considered to be a reasonable worst case for the purposes of the assessment in terms of safety.

2.2.2 The design of the BESS and its impact are controlled in several ways. Prior to commencement of construction of the BESS, a BSSMP (in accordance with the Outline BSSMP) is required to be submitted to the relevant local planning authority and approved, in consultation with the HSE, Lincolnshire County Fire and Rescue Service and the Environment Agency. The Applicant must operate the BESS in accordance with the approved plan.

2.2.3 Further, pursuant to a requirement of the Development Consent Order (DCO), the detailed design of the BESS must be in accordance with the Outline BSSMP (which includes various safety requirements for the BESS design) and the Concept Design Parameters and Principles document **[EN010133/APP/C7.15]**. The Concept Design Parameters and Principles contain controls over the BESS, which include that the chemistry of the BESS will be lithium-ion.

2.2.4 The concept design consists of the BESS containers and the associated transformers, circuit breakers and inverters. The BESS, containers, and auxiliary system, such as cooling, uninterruptible power supply (UPS), fire detection and suppression systems, monitoring and control, will be designed in accordance with internationally recognised good practice guidance available at the time.

2.2.5 Once operational, the plant will be designed to operate unmanned with access required for maintenance only, and with a minimum Operational Life of 40 years.

2.3 Potential BESS Failure

2.3.1 There are four main ways in which a lithium-ion cell can fail: thermal, electrical, mechanical, and chemical. The causes of failure could include issues such as: manufacturing defects, overcharging, over-discharging, mechanical damage, overheating or abuse and short circuits; whether internal or external.

2.3.2 Regardless of the type of failure or the cause, the main potential hazard is thermal runaway and ultimately, if not controlled, a fire, and therefore this report focusses on reducing fire risk associated with the BESS and managing the hazard in the unlikely event that it occurs.

2.3.3 Other electrical systems than the batteries which form part of the BESS can carry fire risks, however due to the extensive historic long-term deployment of other technology such as transformers, inverters and switchgear, these risks are better understood and regulated, through longstanding industry guidance and codes. Therefore, only the battery component of the BESS is addressed in this report.

2.4 Safety Objectives

2.4.1 The safety objectives for the design of the BESS are:

- To minimise the likelihood of an event. This is an overriding priority;
- To minimise the consequences should an event occur;
- To restrict any event to the BESS site and minimise any impact on the surrounding areas;
- To automatically detect and begin to fight a fire as soon as possible;
- To ensure any personnel on Site are able to escape safely away from the Site;
- To ensure that firefighters can operate in reasonable safety where necessary;
- To ensure that fire, smoke, and the spread of gases do not significantly affect occupants in surrounding buildings and areas;
- To ensure that firewater run-off is contained and treated.

2.5 Relevant Guidance

2.5.1 Guidance documents and standards considered by the Applicant have been used to inform the design of the scheme.

2.5.2 There is currently limited UK specific guidance for BESS, however the Applicant has incorporated good practice from around the world.

2.5.3 The Applicant has developed the BESS in accordance with all relevant legislation and good practice. This document takes into account the recommendations of the following good practice documentation used in the UK for similar sites, including:

- National Fire Protection Agency (NFPA) 855 (United State of America).
- Underwriters Laboratories (UL) 9540A Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems.
- United Kingdom Power Networks (UKPN) Engineering Design Standard 07-0116: Fire Energy Storage Systems, 2016
- DNV GL-Recommended Practice-0043: Safety, Operation and Performance of Grid-Connected Energy Storage Systems, 2017.
- Scottish and Southern Energy TG-PS-777: Limitation of Fire Risk in Substations, Technical Guide, 2019.
- BS 5839 Part 1 2017: Fire Detection and Fire Alarm Systems for Buildings
- The Regulatory Reform (Fire Safety) Order (RRO) 2005.
- IEC 61936, Power installations exceeding 1 kV AC and 1,5 kV DC – AC.

3 Consultation

3.1 Lincolnshire Fire and Rescue

3.1.1 The local fire and rescue service, Lincolnshire Fire and Rescue (LFR) has been consulted during pre-application discussions and as part of the Section 42 Statutory Consultation exercise.

3.1.2 A formal written response was received from LFR on 9th September 2022. This states:

"LFR recognises the use of batteries (including lithium-ion) as Energy Storage Systems (ESS) is a new and emerging practice in the global renewable energy sector. As with all new and emerging practices within UK industry the Service would like to work with the developers to better understand any risks that may be posed and develop strategies and procedures to mitigate these risks."

3.1.3 Further comments made by LFR in their responses are set out in the table below.

Table 6.1 Lincolnshire Fire and Rescue Recommendations

Lincolnshire Fire and Rescue Recommendations
Procuring components and using construction techniques which comply with all relevant legislation
The inclusion of Automatic Fire Detection systems in the development design
Including automatic fire suppression systems in the development design. Various types of suppression systems are available, but the Service's preferred system would be a water misting system as fires involving Lithium-ion batteries have the potential for thermal runaway. Other systems would be less effective in preventing re-ignition.
Including redundancy in the design to provide multiple layers of protection.
Designing the development to contain and restrict the spread of fire through the use of fire-resistant materials, and adequate separation between elements of the Battery Energy Storage System (BESS).
Developing an emergency response plan with LFR to minimise the impact of an incident during construction, operation and decommissioning of the facility.
Ensuring the BESS is located away from residential areas. Prevailing wind directions should be factored into the location of the BESS to minimise the impact of a fire involving lithium-ion batteries due to the toxic fumes produced.
The BESS facilities should be designed to provide: - Adequate separation between containers. - Provide adequate thermal barriers between switch gear and batteries, - Install adequate ventilation or an air conditioning system to control the temperature. Ventilation is important since batteries will continue to generate flammable gas as long

as they are hot. Also, carbon monoxide will be generated until the batteries are completely cooled through to their core.

- Install a very early warning fire detection system, such as aspirating smoke detection/air sampling.

- Install Carbon Monoxide (CO) detection within the BESS containers.

- Install sprinkler protection within BESS containers. The sprinkler system should be designed to adequately contain and extinguish a fire.

- Ensure that sufficient water is available for manual fire-fighting. An external fire hydrant should be located in close proximity of the BESS containers.

– The water supply should be able to provide a minimum of 1,900 l/min for at least 120 minutes (2 hours). Further hydrants should be strategically located across the development. These should be tested and serviced at regular intervals by the operator. If the site is remote from a pressure feed water supply, then an Emergency Water Supply (EWS) meeting the above standard should be incorporated into the design of the site e.g. an open water source and/or tank(s). If above ground EWS tanks are installed, these should include facilities for the FRS to discharge (140/100mm RT outlet) and refill the tank.

- The site design should include a safe access route for fire appliances to manoeuvre within the site (including turning circles). An alternative access point and approach route should be provided and maintained to enable appliances to approach from an up-wind direction.

- As the majority of BESS are remotely monitored, consideration should include the fixing of an Information Box (IB) at the FRS access point. The purpose of the IB is to provide information for first responders e.g. Emergency Response Plan, to include water supplies for firefighting, drainage plans highlighting any Pollution Control Devices (PCDs) / Penstocks etc for the FRS.

3.1.4 The Applicant subsequently met with the LFR on 4th October 2022 to discuss specific design measures to incorporate into the Scheme. These are discussed further below.

4 BESS Safety Requirements

4.1 Safe BESS Design

4.1.1 The BESS will be designed to address prevailing industry standards and good practice at a time of design and implementation.

4.1.2 The current industry standard is NFPA 855, Standard for the Installation of Stationary Energy Storage System (Ref 1-1) and the Applicant also requires any system selected to comply with UL9540 (Ref 1- 2), which demonstrates the fire propagation for lithium-ion batteries at cell, module unit level.

4.1.3 In addition to this, good practice guidance for electrical sites within the UK has been consulted with regards to Site layout and separation distances for the transformers and inverters.

4.1.4 Fire safety provisions typically found within battery system design are as follows:

- Battery modules with safety features designed into the cell level such as:
  - Internal fuses;
  - Contactor at rack/string and bank level;
  - Overcharge safety device;
  - Internal separating layers;
  - Venting device;
  - Thermal monitoring.

System Location

4.1.5 Within the Cottam Site the selection of the location of the BESS has been based on a number of factors. The most pertinent factor being the selected Site has tried to minimise the proximity to receptors of any nuisance with the distance to properties maximised where possible. This has the benefit of reducing the visual and noise impact but also minimises any potential impacts on the local population should an event occur. The location of the proposed BESS is more than 320m from any residential properties.

System Layout

4.1.6 The layout of the system will provide separation between key components or groups of key components.

4.1.7 The BESS will be broken into discrete groups consisting of battery containers and inverters and transformers. Each group will be separated from the next. This separation will limit any fire that is not able to be contained to the affected group or part of the battery system and also allow emergency access in case of an intervention.

4.1.8 The container group would consist of up to 12 modular containers. Strings of modular battery storage and interconnector containers will be separated from each other and surrounding infrastructure by a minimum of 3.0m for accessibility and to mitigate the propagation of fire to adjacent infrastructure.

4.1.9 The separation distance between the battery containers and Order limits boundary will be in accordance with NFPA 855 which is currently a minimum of 15m in the concept design. This far exceeds the current NFPA guidance of 3m.

4.1.10 The separation of the inverters and transformers will, depending on the architecture, be optimised at detailed design stage to minimise the likelihood of any spread of fire between adjacent components.

4.1.11 The areas between and around equipment will be finished with gravel and kept free of vegetation or other material that could act to spread a fire.

4.1.12 NFPA 855 recommends the following separation distances for BESS located outdoors:

- BESS should be separated by a minimum 3m (10 ft) from the following exposures:
    - Site boundaries;
    - Public rights of way;
    - Buildings;
    - Stored combustible materials;
    - Hazardous materials;
    - High-piled stock;
    - Other exposure hazards not associated with electrical grid infrastructure.
- These limits may be reduced to 1m where testing to UL9450 has been undertaken.

BR 187 External fire spread: building separation and boundary distances (BR 187 2nd edition)

4.1.13 Separation distances in England are generally calculated based on the recommendations of BR 187 External Fire Spread: Building Separation and Boundary Distances (Ref 1-3). Although the BESS containers are not classified as buildings the separation requirements of the BR 187 is easily satisfied by the construction of the containers when they achieve 60 minutes fire resistance for integrity and insultation.

4.1.14 This means that in the unlikely event that all of the system design mitigations and preventative measures fail that should a fire occur, it should be limited to the part of the system that is on fire, (i.e., the overall size of the battery system is inconsequential to the outcome); an event should be limited in size to only that equipment within a group, whether there are one or any number of groups.

Battery System Containers

4.1.15 Battery containers will house the energy storage electrochemical components and associated equipment. Being either one, or multiple containers joined, or close coupled to each other. They will be mounted on a concrete foundation.

4.1.16 The battery containers will be designed and constructed by the manufacturer in accordance with the good practice available at the time, such as the current guidance outlined in the NFPA 855, Standard for the Installation of Stationary Energy Storage Systems. This will ensure the containers will be of robust construction.

4.1.17 The BESS containers will be locked to prevent unauthorised access and, where required, will have a fire rating of 60 minutes (the length of time that the container can withstand a standard fire resistance test) the concept design is rated EI60 as per ISO 13501-2.

Fire Detection and Suppression

4.1.18 In order to achieve the safety objectives, the Scheme will employ monitoring systems that will help identify any abnormal operation and safely shutdown the system before it develops, these systems will be independent of the control systems and equipment that can cause the abnormal event and avoid the use of Safety Integrity Level (SIL) rated risk controls. Other measures include:

- Thermal monitoring of the battery containers and automated cut-out beyond safe parameters;
- Battery cooling systems with automated fail-safe operation;
- Emergency Stop – both remote and local;
- Fire detection suitable to the architecture such as:
    - Very early smoke detection by aspiration (VESDA) system.
    - Gas detection such as H_2 and CO; as early indication of cell failure. Standard heat and smoke detection system.
- Fire suppression equipment such as an aerosol, gas, automatic sprinkler or water mist system

4.2 Safe BESS Construction

4.2.1 The BESS would be constructed in 2 distinct phases. Firstly, the civil works and balance of plant equipment would be started. Then at a suitable point the BESS equipment would be delivered to be installed on the foundations and connected to the balance of plant.

4.2.2 The installation would be subject to pre-requisites such as a contractor emergency protocol detailing the actions to be taken in an emergency, including a construction emergency response plan that would be coordinated with the relevant stakeholders and emergency services. In addition, installation would not take place until practical

provisions were completed such as the water tanks being installed and filled for use in an emergency.

4.2.3 The transportation of the system from the factory will be a combination of sea and land freight. The system is certified for transportation in all potential environmental conditions. The equipment will be certified for transport to UN 38.3. Transportation will be managed in accordance with the European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR) 2019 and the UK guidance on the transport of dangerous goods "Moving dangerous goods, Guidance" Government webpage (Ref 1-4).

4.2.4 The concept design includes BESS equipment prepopulated with batteries and will have undergone Factory Acceptance Testing (FAT). By definition the FAT testing will be undertaken away from Site reducing the risks during on-Site construction with visual inspections and functional testing undertaken before any Site Acceptance Testing (SAT). The Site installation will be supervised by the Original Equipment Manufacturer and done in a hierarchical way to ensure that all necessary systems are available before the next step is required. The outline sequence which is laid out in the manual is as follows:

- Inspect the items in the protective covers;
- Unpack and inspect the items;
- Install on the foundations;
- Once stable inspect the internal components;[1]
- Mechanically anchor the unit to the foundations;
- Connect any dry riser pipes and or the fire suppression system & strobe and siren;
- Install the grounding;
- Electrically interconnect the equipment DC, AC and comms.;
- Cold commission the equipment;
- Hot commission the equipment;
- Test the equipment.

4.2.5 By following a logical sequence of works with each step being built upon the preceding one the system can be safely assembled without risk and all mitigations against issues in place before the next step occurs.

4.3 Safe BESS Operation

[1] *Procedures will be in place with appropriate equipment to deal with any damaged equipment firstly to secure it, then quarantine it before returning for return or replacement.

Control Room

4.3.1 The BESS will be monitored by the on-Site control systems as well as 24/7 monitoring by a remote-control room.

- The control room will also monitor several other sites across the UK, staff will be fully trained and familiar with the technology.
- The control room will also be responsible for the security of the Site with state-of-the-art detection and monitoring systems. These can be repurposed in an emergency to support first responders.
- The control room will have the ability and authority to immediately shut the system down should the need arise.
- The control room will be responsible for the implementation of the emergency plan acting as a point of contact to emergency services.
- The BESS Compound will have signage in accordance with the relevant Electrical Regulations but will also have the control room emergency telephone number should a member of the public or Emergency Services need to make contact.

Control Architecture

4.3.2 Different battery systems have different topologies of control and safety systems that extend all the way to, in some measures, cell level however it is likely that the selected system will have:

- A module monitoring system;
- Each rack or string will typically have a rack/string monitoring system, receiving information from each module;
- Each bank will have a monitoring system, receiving information from each rack/string;
- A Battery Management System (BMS) with built in fail-safe automated algorithms.

4.3.3 The battery system components communicate with a master controller(s) that reads and records this information and uses algorithms to enable to safe operation of the system within these parameters.

4.3.4 These control systems will be failsafe by design with automatic shutdown of parts, or of the whole system, depending on circumstance.

4.3.5 The BMS will identify any failed cells and disconnect them, reducing the risk of a minor cell failure escalating to a failure of cell electrolyte containment. Individual cells will also be enclosed in battery banks, providing secondary containment, with the battery banks then enclosed in 'blocks' or shipping containers, providing tertiary containment against pollution.

4.3.6 The likely chosen technology will include:

Fire Resistant Construction - Container walls with 90-minute fire rating with lockable doors and door sensors ensure safe operation by personnel.

Fire Detection - Gas, smoke and heat detection with automatic activation to detect and suppress a fire to prevent it from spreading to the cells. Controlled shutdown can be manually activated by first responders or automatically triggered by internal safety features.

Security

4.3.7 The Site security profile will be assessed by the Applicant's dedicated security team and the output from this assessment will inform the level of security measures used.

4.3.8 As a minimum, the BESS will have security fencing clearly signed identifying the dangers within the Site and the Control Room freephone telephone number for use in case of emergency.

4.3.9 The Site will also have high quality CCTV with video analytics to identify and prevent unauthorised access to enable the correct security response to be undertaken by the control room.

Maintenance

4.3.10 The BESS will be maintained and operated by skilled personnel ensuring that the system is in optimal condition and that all parts of the system are fully serviced and functional at all times.

4.3.11 Maintenance is likely to be undertaken on the BESS equipment twice a year. This typically consists of a major maintenance period and a minor maintenance period. The major is relatively non-intrusive and involves checking connections and inspections from the transformer down to the module level. This will encompass all BESS equipment supplied by the original Equipment Manufacturer including the fire system. The minor maintenance is typically a visual inspection and rectification of any accumulated noncritical defects.

4.3.12 All maintenance will be undertaken in a carefully controlled manner following the Site safety rules and in accordance with the Operational Environmental Management Plan (OEMP) **[EN010133/ APP/C7.16]** submitted in support of the Application.

4.3.13 During operation all works on the Site will be controlled under safe systems of work. This will mean all work is risk assessed to protect both personnel and equipment. Therefore, safety systems such as fire systems will not be stopped or taken out of service without appropriate mitigation, following the system being made safe so far as is reasonably practicable, and only for the minimum time required to undertake any specific maintenance tasks.

4.3.14 The operation of the BESS will be managed in accordance with the OEMP.

End of life/Disposal

4.3.15 With regards to the decommissioning of the BESS, the requirements will be determined at the procurement contract stage, with the contractor remaining clear that they are the producer of the battery components and the party placing the battery components on the UK market pursuant to the Waste Batteries and Accumulators Regulations 2009 (as amended) and pursuant to the Waste Batteries and Accumulators Regulations 2009 (or such equivalent regulations in force at the time of decommissioning) (Ref 1-5) it has certain obligations in respect of battery disposal.

4.3.16 All components replaced during the defects notification and warranty period will be taken back and recycled.

4.3.17 The Applicant will follow the hierarchy of waste management through the life of the Scheme as follows:

- Reduce – the lithium-ion batteries have finite life based on a number of factors, primarily the total number of cycles undertaken. The operation will attempt to manage the degradation by the selection of services and cycling that maximises the overall life. Consideration will be given to supplementation of the equipment or operation at a lower output.
- Reuse – If the batteries are no longer suitable for use by the Applicant there may still be opportunities to use the batteries for second life applications, such as domestic or windfarm storage.
- Recycle – The supplying manufacturer will have obligations under the Waste Batteries and Accumulators Regulations 2009 (as amended) (or such equivalent regulations in force at the time of decommissioning) and will be contractually obliged to offer a recycling service.
- Recovery – The recycling should allow any useful materials to be recovered and re-enter the supply chain.
- Disposal – Any disposal of batteries shall be undertaken in compliance will all applicable laws and all regulatory requirements, product stewardship, registration disposal and recycling or take back requirement.

5 Firefighting

5.1 Fire Service Guidance

5.1.1 Guidance for the Fire Service for dealing with sites such as powerplants, substations etc. is contained in the Fire Service Manual Volume 2 Fire Services Operations – Electricity (Ref 1-6).

5.1.2 The Fire Service Manual stipulates that in all cases involving electrical apparatus, it is essential to ensure, on arrival, that the apparatus is electrically isolated and safe to approach. This should be carried out by the operator at the premises concerned. It is strongly advised that electrical or associated equipment should not be touched or even approached unless it is confirmed to be isolated and safe.

5.1.3 In the event of a fire, the battery system and the transformers serving the BESS will be automatically electrically isolated when a fire is detected within a container. However, the batteries within the containers will still hold charge in the event of a fire, even after the electrical system is isolated. It will not be possible to confirm that there is no residual risk from the energised batteries within the container, and this will inform the strategy for firefighting in the emergency plan.

5.1.4 The Applicant has engaged with Lincolnshire Fire and Rescue throughout the pre-application phase, which has led to a number of design improvements, which are set out below.

5.2 Fire Service Access

5.2.1 Access will be designed such that emergency services are able to access the Site easily with Site roads being clearly laid out and signed in accordance with the following:

5.2.2 Turning facilities will be provided in any dead-end access route that is longer than 20m. The minimum proposed access-route width to reach the BESS will be 4m.

5.2.3 A swept path analysis for emergency vehicles has been undertaken and the roads have been confirmed as suitable for emergency vehicle access.

5.3 Fire Water

The Concept Design Parameters and Principles **[EN010133/APP/C7.15]**, for the Scheme include the following for water storage structures for the purposes of fire fighting.

- External firefighting water storage structures will be located no less than 50m and no more than 300m from the battery containers.
- The external firefighting water storage units will be no less than 228000 litres in capacity.
- Water storage will either be in sectional steel panel tanks, or cylindrical steel tanks, above or below ground; or will be bunded or excavated ponds.

- Where above ground, tanks will be supported on structural concrete slab foundations to a maximum depth of 1m.

5.3.1 The Illustrative Site Layout Plans for Cottam 1, West A **[EN010133/APP/C6.4.4.3]** and Cottam 1 West B **[EN010133/APP/C6.4.4.4]** show the potential locations of the water storage facilities (tanks or ponds).

5.4 Emergency Planning

5.4.1 The BESS will have a robust and validated emergency plan, developed in consultation with Lincolnshire Fire and Rescue. This emergency plan will include:

- Details of the BESS;
- Overall Site drawings identifying all of the relevant features required in an emergency such as layout, muster points, e-stop locations and firefighting equipment;
- Design drawings and schematics of the system for reference;
- Procedures for the isolation of containers in the case of failure;
- Battery data;
- MSDS (Material Safety Data Sheets);
- COSHH (Control of Substances Hazardous to Health) Assessment;
- Number of Cells;
- Fire detection system details;
- Fire-fighting strategy;
- Conservative plume and explosion impact assessments;
- Review of local risk points (e.g., adjacent trees or infrastructure requiring possible protection from fire propagation);
- Review of fire water provisions;
- Actions to be undertaken in an emergency.

5.5 Firefighting Consequences

5.5.1 As the BESS will not have personnel access into the battery containers, there is unlikely to be any immediate threat to life, only property which forms part of the Scheme.

5.5.2 The emergency services would most likely commit to fighting fire by using water on neighbouring areas such as battery containers, trees, and structures to cool down and prevent further fire spread.

5.5.3 It is not anticipated that firefighting techniques will involve direct jets of water onto equipment and will be limited to containment and cooling of adjacent units to

prevent the fire from spreading. This strategy will be finalised with the local fire authority and be clear in the emergency plan.

5.5.4 A BESS fire could result in the mobilisation of pollution within surface water run-off. As set out in the Hydrology, Flood Risk and Drainage Chapter 10 of the ES **[EN010133/APP/C6.2.10]**, where practical, at detailed design stage it is recommended that runoff from the battery storage area will be contained by local bunding and attenuated within gravel subgrade of lined permeable SuDS features prior to being passed forward to the local land drainage network. In the event of a fire a system of automatically self-actuating valves at the outfalls from the battery storage areas will be closed, isolating the battery storage areas drainage from the wider environment. The water contained by the valves can then be tested and either treated and released or tankered off-site as necessary and in consultation with the relevant consultees at the time.

5.5.5 Chapter 17 of the ES Air Quality **[EN010133/APP/C6.2.10]** (and associated Appendices) assesses the battery fire emission impact on the surrounding area (including residential receptors).

5.5.6 Based on the factors of distance to the nearest property and the short-term nature of a fire incident, the assessment concludes that there will not be adverse effects at the closest receptor locations as a result of a BESS fire incident. Notwithstanding, whilst there is low risk of adverse effects at the closest receptors, the emergency response plan will incorporate the following measures:

- to inform any potentially affected residents within the affected zones and to advise the public about health effects of smoke, related symptoms, and ways to reduce exposure;
- to cancel outdoor events; and/or
- to move affected residents to a cleaner air location.

5.5.7 In addition, a post event action plan will be drawn up that will determine any immediate and follow up actions required to an event.

5.5.8 There are many factors which would inform the design of an investigation following an incident which ultimately account for the volume and concentration of the loss. In the case of a fire to a BESS unit, variables to be considered include:

- Extent of the fire: including duration, number of BESS units impacted, number of adjacent assets impacted;
- Firefighting method: whilst defensive techniques are anticipated, larger volumes of water may be required to dampen and cool adjacent assets, alternative techniques to fight any adjacent fires;
- Location of the fire: adjacent to drainage or close to soft ground;
- Existing Site conditions: recent weather and precipitation levels.

6 Pre-Construction Information Requirements

6.1 Summary

6.1.1 The detailed design phase will determine the approach to addressing the following specific requirements, which will be updated prior to construction of the BESS and submitted to the local planning authority as a detailed BSSMP prior to the commencement of construction. The detailed BSSMP must include:

- The detailed design, including drawings of the BESS;
- A statement on the battery system specifications, including fire detection and suppression systems;
- A statement on operational procedures and training requirements, including emergency operations;
- A statement on the overall compliance of the system with applicable legislation;
- An environmental risk assessment to ensure that the potential for indirect risks (e.g., through leakage or other emissions) is understood and mitigated;
- An emergency plan covering construction, operation and decommissioning phases developed in consultation with Lincolnshire Fire and Rescue, to include the adequate provision of firefighting equipment on-Site.

6.1.2 Provision of the above information will demonstrate prior to construction that all of the considerations and requirements in this document have been addressed and the BESS installation is safe.

6.1.3 Safe decommissioning of the BESS will be addressed prior to decommissioning of the Scheme in a Decommissioning Environmental Management Plan, and in accordance with the Outline Decommissioning Statement [EN010133/APP/C7.2] submitted as part of the DCO Application.

7 Conclusion

7.1 Summary

7.1.1 The Applicant is committed to developing a safe BESS that will provide long dependable operation. It is in everyone's interest that the selected BESS technology is robust, in particular with regards to safe operation.

7.1.2 This report demonstrates that, the Applicant has relevant experience of BESS systems; that the relevant stakeholders have been consulted (and their responses have informed the design of the Scheme), and therefore safety will be inherent in the overall design, minimising the risk of a fire event occurring, and reducing the impact of such an event should it occur.

References:

Ref 1-1: NFPA (2020) NFPA855 Standard for the Installation of Stationary Energy Storage Systems.

Ref 1-2: UL Standard (2020) UL9540A Energy Storage Systems and Equipment.

Ref 1-3: Richard Chitty (2014) External fire spread: building separation and boundary distances (BR 187 2nd edition).

Ref 1-4: [redacted].

Ref 1-5: UK Statutory Instruments (2009) The Waste Batteries and Accumulators Regulations 2009.

Ref 1-6: Fire and Emergency Planning Directorate (1998) Fire Service Manual Volume 2: Fire Service Operations, Electricity.